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THE CORN EARWORM AS AN ENEMY OF FIELD CORN IN THE EASTERN STATES

EVERY CORN GROWER is familiar with the corn earworm, but few realize the full extent of the loss it occasions to the field-corn crop of this country. Conservatively estimated, this loss amounts annually to $40,000,000.

Each grower of corn, with little extra cost or effort, may reduce his loss from earworm ravages by at least one-half if he will select a variety of corn well suited to his local conditions, but having a long, tight husk, and will plant this variety, within the limitations of good yield requirements, so as to have it silk at the most favorable time—that is, when the moths of the earworm are least abundant.

This bulletin describes the different stages of the insect, and shows how it damages corn, how it is partly kept in check by its own habits and its natural enemies, and how a knowledge of its life history will aid the corn grower in protecting his crop.

This bulletin is a revision of and supersedes Farmers' Bulletin No. 1310, The Corn Earworm: Its Ravages on Field Corn and Suggestions for Control.

Washington, D. C. Issued January, 1931

THE CORN EARWORM[1] AS AN ENEMY OF FIELD CORN IN THE EASTERN STATES

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IMPORTANCE AS A CORN INSECT

THE CORN EARWORM is the most destructive insect enemy of ear corn in the United States and it occurs throughout this country wherever corn is grown. It is most destructive in the Southern States, where the breeding season is longer and where its most important secondary host plant, cotton, is grown in abundance. Sweet corn is especially attractive to the earworm. Even in the North the losses are heavy, while in the South the production of sweet corn is rendered almost impossible by this insect. Although field corn is not so severely injured, nevertheless it has been estimated that 2 per cent of this crop is destroyed annually by the earworm. Even at the low farm valuation of the 1929 crop of corn ($2,048,134,000)[2] this means a loss, for this crop alone, of over $40,000,000. In other words, the American farmer grows, on an average, approximately 2,000,000 acres of corn each year to feed the earworm.

OTHER FOOD PLANTS

Although corn is its favorite food, this pest is also an important enemy of several other crops. On cotton it ranks, in amount of damage done, next to the boll weevil. When feeding on cotton it is called the "bollworm." Under the name of "tomato fruitworm" it is known as a very destructive enemy of early tomatoes in the

[1] *Heliothis obsoleta* Fab., order Lepidoptera, family Noctuidae.
[2] United States Department of Agriculture Yearbook, 1930, p. 626.

Southern States. The late broods attack the buds and seed pods of tobacco and feed also within the pods of string beans. The larvae prefer to feed upon the grain or fruits of its various host plants, but when these are not available the leaves are devoured, especially where the insect is very abundant. On vetch, for example, the earworm assumes migratory habits similar to those of the armyworm. Alfalfa is sometimes attacked, especially in the irrigated sections of the Southwest.

In addition to being a major pest of the crops mentioned above, the earworm larvae can subsist on a great variety of other plants, some of which are cowpea, okra, sunflower, beggarweed, crab grass, castor bean, squash, and green peppers, to mention only a few of the more important ones.

This great variety of food plants, as well as its manner of feeding, renders the control of the corn earworm difficult. It should be remembered, however, that where corn in the milk stage is available this is attacked in preference to any other food.

HOW CORN IS DAMAGED

In spite of the large aggregate losses due to the work of the earworm in corn, growers generally have become tolerant of the pest. This is largely due to the fact that they have been familiar with its depredations for many years and do not realize the extent of the losses caused by it.

The damage is caused entirely by the worms or larvae of the insect. In the early plantings the worms attack the "buds" or central shoots, feeding on the tender unfolding leaves. (Fig. 1.) When these injured leaves unfold they present a ragged and unsightly appearance, and such damage is often termed "ragworm" or "budworm" injury. Most frequently such damage results only in slightly reduced yields, although occasionally the plants are badly stunted and produce little grain.

When tassels appear the worms immediately attack them (fig. 1), but this feeding rarely results in serious injury.

Although the moths will deposit eggs on practically any part of the plant, they prefer the fresh silks, and as soon as these appear the majority of the eggs are laid on them. (Fig. 12.)

When the silks and ears appear, the larvae desert all other parts of the plant and turn their attention to them. Earworm larvae feed upon the silks as long as these are fresh, although such feeding is done, except in rare instances, within the protection of the shuck. Newly hatched larvae crawl to the tip of the shuck, push their way in between the silk strands, and start to feed. Corn silk is an attractive food for the larvae only while it is fresh; after it dries out the larvae feed upon the developing kernels. The worms may become full grown upon silk alone in case the shuck is long and fits tightly about the silk. Where the shucks are short and fit loosely about the ear the worms start feeding at once upon the exposed kernels. Partly matured worms, coming to the silks from the tassels, may sometimes sever the silks (fig. 2) before fertilization is complete, thus causing nubbins and poorly filled tips. It is not known to what extent this occurs.

The principal injury occurs when the worms reach the ears, where many of the kernels are destroyed (figs. 3 and 9) while still soft. As the kernels harden the larvae burrow under them, feeding on the germ parts (figs. 3 and 4), which remain soft for a longer

FIGURE 1.—Corn earworm injury to bud (at left) and tassel (at right) of corn Reduced nearly one-half. (Quaintance and Brues)

period. This type of injury is also important, as such kernels drop out during shucking and handling (fig. 5) and become a total loss.

Careful observations in Virginia have shown that the actual feeding of earworms on the kernels causes from 1 to 17 per cent reduction

in the weight of shelled corn. The writers have observed some fields, grown under exceptionally unfavorable conditions, where the loss due to earworms would easily reach 50 per cent.

INJURY TO GRAIN BY OTHER ORGANISMS FOLLOWING EARWORM FEEDING

The indirect injury to the ears which results from the work of the earworm is sometimes as important as the direct loss. Molds, which would not otherwise gain entrance to the ears, are carried in by the worms, or enter with rain through holes in the husk

FIGURE 2.—Partly grown earworm severing fresh silks before fertilization of the ear is complete. Slightly reduced. (Photo by R. C. Smith)

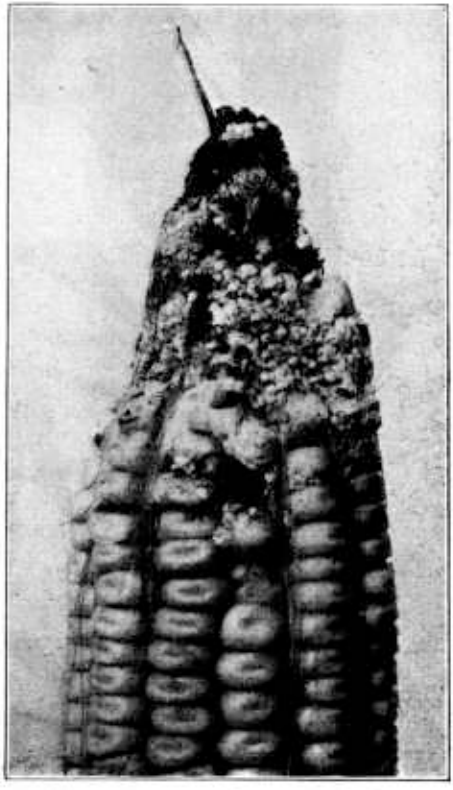

FIGURE 3.—Ear showing serious earworm injury. Note abundant excrement where a large number of kernels have been entirely destroyed while soft; also partly visible earworm still feeding in the germ part of the hardened kernels. Slightly enlarged. (Photo by R. C. Smith)

(fig. 6) bored by earworms or at the tip where silks severed by the worms have fallen out (fig. 2). Within the ear, molds breed upon the mass of excrement (fig. 3) and damaged kernels (fig. 7) left by the worms, and often destroy the remaining uninjured kernels. Ears severely injured by molds are unsafe to use for feed, especially for horses. Other insects, such as the grain beetles and weevils, which are unable to penetrate sound, long, tight husks, often gain admission to the ears through husks (fig. 6) or silks (fig. 2) injured by earworms. In the far South the work of these pests is very important. This

kind of damage would be greatly reduced if all ears had long, tight husks, which largely prevent the entrance of earworms.

It is impossible accurately to estimate the loss which in these ways is indirectly due to the earworm feeding. It is probably at least half as great as that caused by direct injury.

OTHER INSECTS CAUSING SIMILAR INJURY TO CORN

Several other insects cause injury to the buds of young corn similar to that caused by the earworm. Among these are the larger corn stalk borer (*Diatraea zeacolella* Dyar), the southern corn rootworm (*Diabrotica duodecimpunctata* Oliv.), the common stalk borer (*Papaipema nebris* Guen., form *nitela* Guen.), and the fall army worm (*Laphygma frugiperda* S. and A.).

FIGURE 4.—Injured ear typical of results of germ feeding by earworm. Note missing kernels. About five-eighths natural size. (Photo by R. C. Smith)

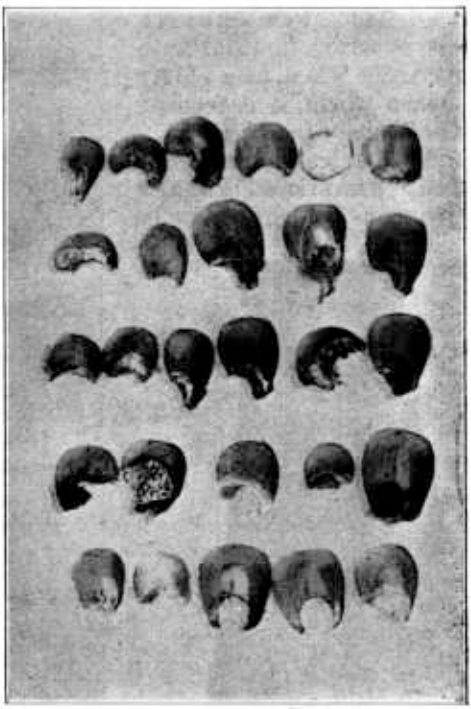

FIGURE 5.—Hardened kernels with germ portions destroyed by earworms. Such kernels drop from ears during handling and represent serious loss. Natural size. (Photo by R. C. Smith)

The ears of late corn also are frequently attacked by larvae of the fall army worm, and an occasional cutworm makes its way to the ear. The corn earworm can be distinguished from these other larvae, however, by the presence of the characteristic and conspicuous stripes that run the full length of the body.

The European corn borer (*Pyrausta nubilalis* Hbn.) frequently feeds in the ears of corn, causing injury similar to that of the earworm. The larvae of this insect are cream colored and about an inch long when full grown. They feed throughout the plant, in the tassel, stalk, shuck, ear, and cob. Feeding often starts in the tassel, the

larvae burrowing downward in the stalk. The tassel thus weakened often breaks over, a character frequently used in detecting the presence of this insect in cornfields. The corn borers pass the winter as larvae in the cornstalks, where they pupate and give rise to moths the following May and June, whereas the corn earworms pass the winter as pupae, several inches below the surface of the soil.

THE STAGES OF THE EARWORM

During its lifetime the corn earworm passes through four distinct stages—the egg (fig. 8), the larva or worm (fig. 9), the pupa (fig. 10), and the moth or adult (fig. 11). Few growers, however, are familiar with it except when, as a partly grown worm, it is feeding voraciously in the ear.

If the leaves are carefully examined in the spring a few eggs may be found. Later, when the silks are beginning to appear, the eggs are more easily detected because large numbers are often laid on the silks of a single ear. (Fig. 12.)

FIGURE 6.—Hole through husks made by earworm. Such openings afford entrance to rain, molds, and weevils. About natural size. (Photo by R. C. Smith)

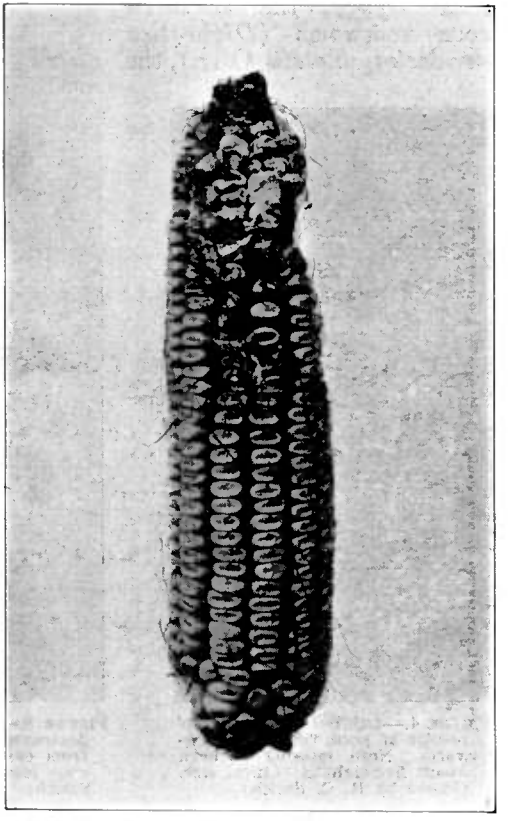

FIGURE 7.—Severe earworm damage followed by mold injury. About one-half natural size. (Photo by R. C. Smith)

THE EGG

The egg (fig. 8) is about half the size of the head of a common pin. It is shaped like a ball flattened at opposite ends. When first laid it is light yellow, but appears white against the dark green of

the corn plants. It soon darkens and when ready to hatch has become a dusky brown. Hatching occurs from two to eight days after the egg is deposited, the length of time depending on the temperature.

THE LARVA OR EARWORM

The newly hatched larva is whitish, with a black head, and is very small. Growth is very rapid. The worm attains full size in from 13 to 28 days after hatching. The increase in size is accomplished by the process known as molting. Every two to five days the old hard skin is split down the back and cast off, after which the worm expands greatly in size before the new skin has become hardened. Five such molts usually occur during the process of growth. Each molt is preceded by an inactive period of some hours, during which the larva is helpless. When full grown (fig. 9), the earworm is about 1½ inches long and very robust. The coloration at this time varies greatly, many of the larvae being beautifully marked with conspicuous stripes. A few are without stripes and may be pink, green, cream, or yellow; the majority are marked with prominent stripes of varying shades of cream, yellow, brown, slate, and black. Although, as stated, some larvae are in one-color tone, the majority have stripes and dots of two or three colors. The larval stage is the only destructive stage of the insect. When one has become acquainted with the habits, arrangement of the stripes, and general robust appearance of the earworm, it is not easily confused with any other insect found on corn. The best way to become familiar with the larva is to open several ears of infested corn in midsummer and examine the larger worms. (Fig. 9.)

FIGURE 8.—Eggs of earworm on corn leaf. About eight times natural size. (Photo by R. C. Smith)

THE PUPA OR RESTING STAGE

When full grown the larva leaves the ear, usually by boring out through the husks (fig. 6), and drops to the ground. It enters the soil as soon as possible, and bores down to a depth of from 1 to 9 inches, varying with the hardness of the soil, moisture, and weather conditions. The larva then forms a cell. (Fig. 13.) In order that the moth may easily reach the surface, a smooth open passageway is constructed from the cell to within about one-half inch of the surface; then the larva returns to the cell, where it transforms into a pupa. (Figs. 10 and 13.) During this resting stage the great changes take place by which the worm becomes the moth. The pupa is light brown, about three-fourths of an inch long, and rather stout. It is very delicate and helpless. Many pupae are destroyed by moles and other enemies, and by the disturbance of the cells in the process

of plowing or harrowing. When the changes are complete the moth emerges from the pupa and makes its way to the surface, where the wings expand and harden. In midsummer the period from the time

FIGURE 9.—Nearly full-grown earworm devouring silks and soft kernels of sweet corn. Note typical striped appearance of the larva. About one and one-half times natural size. (Photo by R. C. Smith)

the larva leaves the ear until the moth emerges may be as short as 14 days. It is usually somewhat longer, and it may be several months, as the insect passes the winter in the pupal stage.

THE MOTH OR ADULT

The moth (fig. 11) is about three-fourths of an inch long and has a wing expanse of 1½ inches. The coloration is dull and the shades vary from a light olive green to a rather dark reddish brown. Although it is not strongly attracted to lights, it is similar to those moths which are common about lights in the summer. The moth makes itself so inconspicuous that the grower may seldom see one, unless it is noticed at midday resting in the central shoot or bud of a corn plant. The moths become active in the early evening, feed on the nectar of various flowers, and then fly in search of suitable plants on which to lay their eggs.

Soon after emergence, mating takes place and egg laying begins. Each female deposits many eggs in an evening, distributed over a number of plants taken at random. The eggs are laid singly, but many may be laid on parts of one plant before another is visited. The females live about 12 days, and during this time each may deposit between 400 and 3,000 eggs, the average being about 1,000. The moths are extremely active, strong and rapid fliers and may fly long distances in search of suitable plants on which to lay their eggs.

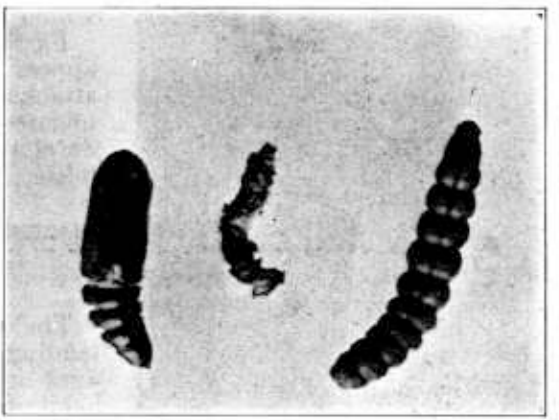

FIGURE 10.—The corn earworm. At right, larva after entering ground and ready to pupate; in center, cast skin; at left, pupa. About one and one-fourth times natural size. (Photo by R. C. Smith)

SEASONAL HISTORY

Within certain limits, the lengths of the egg, larval, and pupal stages of the corn earworm vary with the temperature, being shorter in hot weather and longer in cooler weather. If each stage were passed in the shortest time as given above, the entire life cycle could be completed in a month. In other words, under the most favorable conditions it requires only 30 days from the time an egg is laid until the adult insect appears. In the southern part of the United States this rapid development does occur in midsummer, and there may be as many as seven generations of the earworm annually. In the extreme northern part of the country, however, there is only a single generation each year. Between these extremes the number of generations varies with the latitude, altitude, and other factors which influence seasonal temperatures. Throughout the greater part of the Corn Belt there are three or four generations annually. The number of generations largely determines the destructiveness of this pest in any given area.

In Virginia the moths begin to emerge from the overwintering pupae during the last part of May or the first week in June and

continue emerging until the last week of July. Their eggs, which begin the first generation of the year, are most abundant during the last of June and the first two weeks of July. In the last part of July or the first part of August, depending on the season, there is usually a period during which few or no eggs can be found by the most careful observation. Moths of the first generation soon appear, and eggs are deposited in greater abundance than before. These eggs begin the second generation. From this time until frost eggs can always be found, the broods overlapping, though the eggs are more abundant at some periods than at others. The earliest moths of the second generation appear during the last part of August and lay the eggs that begin the third generation. In Virginia it is this generation which passes the winter in the pupal stage.

FIGURE 11.—The adult, or moth of the earworm resting on corn leaf. About one and one-fourth times natural size. (Photo by R. C. Smith)

Farther south the moths appear earlier in the spring, attacking corn, vetch, and tomatoes. The later generations develop on late corn, cotton, and tobacco.

NATURAL LIMITING FACTORS

CANNIBALISM

The most important factor tending to reduce earworm ravages on corn is the earworm's habit of cannibalism. Wherever two worms come into chance contact with each other they fight until one or both are injured beyond recovery. If one survives, it will often partly or entirely consume its foe. Since by far the greater number of the newly hatched worms enter the ears through the silks, contact is very frequent and only a few worms survive to reach the kernels. Scores of larvae sometimes enter ears, but few survive because of this cannibalistic habit. This is especially true where husks are long and tight (fig. 17), because, in this case, the silk channel is long and narrow, and the chances for more than one survivor are greatly lessened. When husks are short or loose (fig. 16), worms easily find their way to various parts of the ear without feeding much on the silk or disturbing one another. When thus widely separated they feed unmolested and many more reach maturity. Comparatively few worms enter the ear by boring through the husk.

PARASITES AND PREDACIOUS ENEMIES

A tiny wasplike insect (*Trichogramma minutum* Riley) is the most important egg parasite. (Fig. 14.) Although it is usually present in the cornfields, it varies greatly in abundance. Occasionally

in some seasons fully 90 per cent of the eggs fail to hatch because of the work of this insect. This little parasite also attacks the eggs of many other injurious insects.

FIGURE 12.—Ear in full silk, at the stage when it is most attractive to the earworm adults for egg laying. Note the large number of eggs scattered through the silks. Slightly enlarged. (Quaintance and Brues)

Earworms feeding upon the ears of corn are usually fairly well protected and parasitism under this condition is therefore rare and unimportant. When the larvae feed upon such plants as vetch

and alfalfa they are easy prey to several parasites, particularly a two-winged fly (*Winthemia quadripustulata* Fab.).

The pupa is formed within the soil and therefore is practically secure against parasitism.

The most important predatory insect enemy of the earworm egg and small larva is a small blackish bug (*Triphleps insidiosus* Say) (fig. 15) about one-sixteenth of an inch in length. Although this

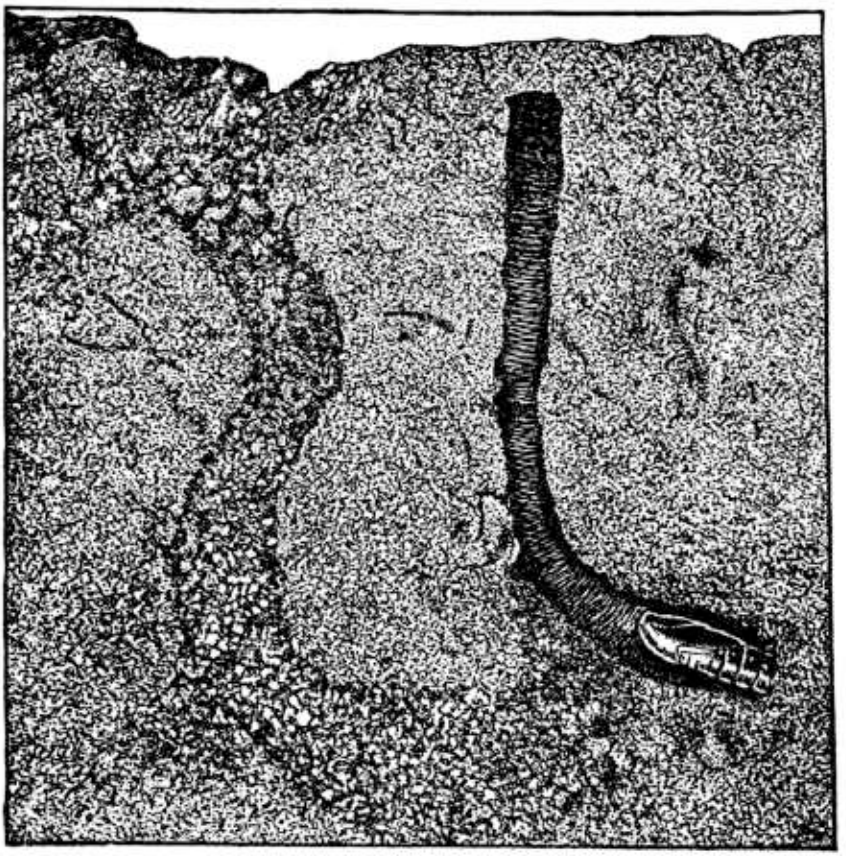

FIGURE 13.—Pupa of the earworm in its burrow in the soil. Note the disturbed soil where the larva worked its way down and the smooth channel constructed for the escape of the moth. About one and one-fourth times natural size. (Drawn from Quaintance and Brues)

bug occurs upon many species of plants, it is perhaps most abundant upon corn, on which it prefers to breed. These bugs are especially abundant on corn silks, in which they deposit their eggs and upon which the reddish nymphs feed. These little bugs are very active and destroy great numbers of earworm eggs and young larvae by puncturing them with their beaks and sucking out the contents. Sometimes as many as 25 of these bugs may be found on a single corn plant.

The Bureau of Biological Survey states that 21 species of birds are known to feed on the corn earworm. Most important are the

Brewer's and California red-winged blackbirds, the boat-tailed grackle, English sparrow, and downy woodpecker. As many as 10 larvae of the earworm have been found in a single stomach of the cardinal and more than 50 in that of the boat-tailed grackle.

Moles are undoubtedly the most important enemy of the earworm pupae. Late in the season cornfields may be noticed in which mole tunnels branch out in all directions. Moles undoubtedly destroy large numbers of the pupae of the earworm in such fields. Their taste for this food is so keen and they are so clever in locating the pupae in the soil that it taxes the entomologist's ingenuity to devise mole-proof cages for the earworm pupae used for experimental purposes.

FIGURE 14.—Earworm egg parasitized by *Trichogramma minutum*. About twenty-four times natural size. (Quaintance and Brues)

WEATHER CONDITIONS

Variable weather conditions have an important effect upon the earworm throughout its seasonal history. Summer storms are among the most important of weather factors in limiting the abundance of the insect. Wind and rain dislodge many eggs which fall to the ground and are destroyed. The first frosts and freezes in the fall kill all larvae that are not well protected from the cold. Large numbers of hibernating pupae die in the soil from cold, excess moisture, and other unfavorable conditions. In central Virginia not over 5 or 6 per cent of the larvae which enter the soil in the fall survive to emerge as moths the following spring.

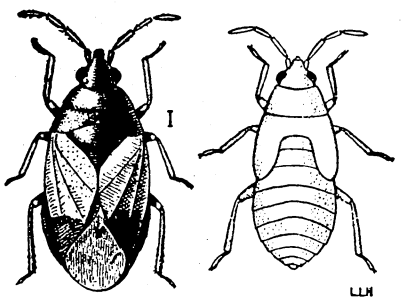

FIGURE 15.—Adult and nymph of *Triphleps insidiosus*. This bug destroys large numbers of eggs and young larvae of the earworm. About fifteen times natural size. (Quaintance and Brues)

DISEASE

During prolonged periods of wet weather large numbers of larvae die within the ears of corn as a result of certain diseases. Many more die from similar causes after they enter the soil to pupate. Many pupae die of disease in the hibernation burrows. The young larvae rarely seem to suffer in this manner. As a whole, disease is an important factor in limiting the earworm.

IMPORTANCE OF NATURAL AGENCIES

Considered collectively, all the natural limiting factors profoundly affect the abundance of the earworm and account for the fact that rarely more than two to five larvae survive to maturity upon a single ear of corn.

Were it not for the important aid rendered by these agencies the injury to the crop would be many times greater and would probably make corn growing very difficult if not well-nigh impossible. Unfortunately, these natural agencies do not effect a sufficient degree of control to render artificial measures unnecessary.

METHODS OF LIMITING DAMAGE TO FIELD CORN

The earworm is of such general occurrence and has been known as a pest for so long that the farmer, especially in the Southern and Central States, has come to look upon its presence as an inevitable consequence of corn planting. Expensive methods of control are not warranted because of the small margin of profit and the relatively low commercial value of the crop. Furthermore, it is grown over such large areas that individual treatment of each plant is impracticable. As a rule, therefore, little has been done by the grower to combat the pest.

A careful study of the problem for a period of years has shown that the major part of the earworm depredations may be prevented if the farmer will act in accordance with the following simple suggestions. The practices recommended, for the most part, add very little to the labor and expense ordinarily required in growing the crop.

TIME OF PLANTING

The most favorable time to plant field corn in order to limit earworm injury is as early in the season as is consistent with favorable conditions for germination and growth. A long series of studies made in central Virginia has shown that, on an average, field corn planted in that district the last week in April was damaged the least, and those plantings made during the last week in May and the first two weeks of June were most severely injured by the earworm. Corn planted between these dates was injured to an intermediate degree. Late-planted fields have been observed in central Virginia in which fully 50 per cent of the kernels were destroyed by the earworm. Late plantings are not only more severely damaged, but great numbers of larvae enter the soil to hibernate, and thus serve to stock the soil with the insect for the following year. On the other hand, moths that emerge in early-planted fields fly elsewhere in search of food and suitable places for oviposition, since such corn is no longer very attractive to them; therefore, very few individuals enter hibernation under these conditions, thus reducing the infestation for the succeeding year.

It is also very important to plant all of the field corn for the locality or community within as short a period as possible in order that all the plants may come into silk at approximately the same time. A short planting period gives a relatively short period during which the season's planting of corn is susceptible to attack by the earworm. In addition, this tends to distribute the earworm injury throughout the entire crop, so that it is not unduly concentrated on any one field. Likewise, missing hills should not be replanted, as plants from such hills silk much later and attract moths to the field for oviposition, thus greatly increasing earworm injury.

Where the larger corn stalk borer occurs in destructive numbers its presence should be taken into consideration in determining the planting date. In eastern Virginia this insect frequently does serious

damage to corn planted before the first week in May. Therefore, corn should be planted as early as is consistent with escape of serious injury by the stalk borer, which, in Virginia, is about the first week in May.

The planting periods suggested here apply particularly in central Virginia, where the insect has been most intensively studied. They apply to long-season varieties; the short-season varieties should be planted about 10 days later to escape serious damage by the earworm.

CHARACTER OF HUSK

The character of the enveloping husk is a very important factor influencing earworm injury to corn. The most desirable husk should extend from 2 to 6 inches beyond the tip of the ear, and above all it should close tightly around the silks. The writers have found that ears so protected suffer only half the loss in weight shown by ears of the same variety grown under identical conditions and with the same percentage of infestation but having loose husks. The most undesirable husk type is one that is loose about the grain and is so short that the tip of the ear is exposed. This has held true for nine varieties having different husk characters. Where husks are tight, ears with very long husks are less damaged by the earworm than ears having only moderately long husks. Moreover, very long, tight husks have been found to be of great assistance in reducing weevil injury to corn. Bird injury to corn in the field is much less in ears with long tight husks than in those having short or loose ones. (Fig. 16.) Where these types of injury are important, the grower should select for seed ears having husks which are not only tight but also quite long. (Fig. 17.) By such wise selection the corn grower can obtain these desirable husk characters in the variety which he has found best suited to his needs and greatly reduce the losses from these various causes.

FIGURE 16.—Undesirable husk characters. Note bird injury to exposed tip. Ears having husks of this type are especially susceptible to earworm injury. (Photo by R. C. Smith)

SOIL PRODUCTIVENESS

To plant corn on poor land is to invite severe earworm injury. This is because of the long, irregular silking period and the high percentage of poor ears produced on such soil. Fertilization, crop rotation, the use of legumes, and other measures which increase the productiveness of the land and make for a better crop of corn, aid in reducing the severity of earworm injury.

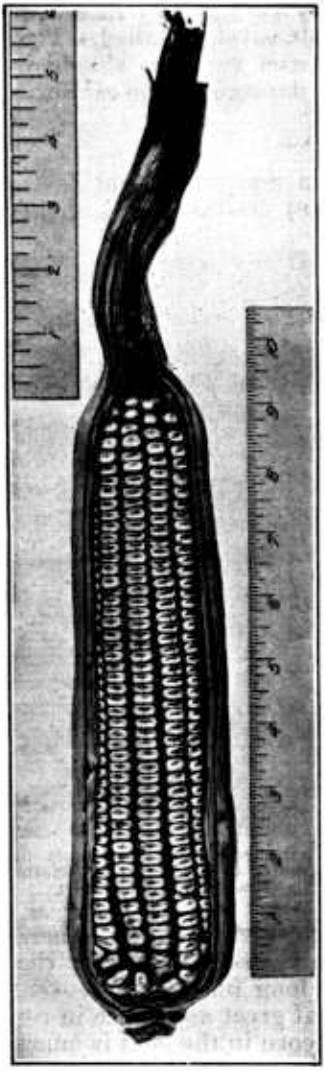

FIGURE 17.—Desirable husk characters. Shuck protection like this will greatly reduce both earworm and weevil injury. (Kyle)

PLOWING

Plowing of cornland at some period during the fall, winter, or spring has been recommended as a control for earworms for many years. It will be recalled that the larva burrows into the soil in the fall to a depth of from 1 to 9 inches and then constructs a tunnel or burrow extending upwards to within a half inch of the surface of the soil. The moth is rather delicate, and if such a tunnel were not provided it could not reach the surface of the soil to fulfill its function of egg laying. The advantage of plowing is to destroy the hibernating pupae, or to disturb their emergence burrows so as to make the emergence of moths impossible. In the operation of plowing, many pupae are crushed, others have their emergence burrows obliterated and the moths are thus unable to reach the surface. In heavy soils plowing may be done at any time during the fall, winter, or spring, but in light, friable, or sandy soils plowing seems to be most desirable during the fall or winter. Soils subject to erosion through the winter should not be plowed in the fall. Undoubtedly marked beneficial results could be obtained if the farmers of an entire community would plow, during the fall or winter, all fields and fence rows that had produced corn, or other crops, or weeds, upon which the late broods of earworms had developed.

DEGREE OF CONTROL POSSIBLE

A question which naturally will arise in the grower's mind is, To what degree can this insect be controlled by the use of methods suggested in this bulletin? The writers have found that a very

marked control is possible. In 1921, a year of very heavy infestation, the ears which had long, tight husks, which silked at the most favorable time, and were of a variety well suited to local conditions, had less than one-half of 1 per cent of corn eaten by earworms. On the other hand, a variety which had a short, loose husk, and which was planted at an unfavorable time, showed 17 per cent loss. This difference shows the degree of control effected by changes in cultural practice alone, and without community cooperation. Effort by an entire community would doubtless effect much better results.

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